AGENCY ~~REVIEW~~
~~RESPONSE~~APPROVAL DRAFT

# Bathymetry Survey Field Sampling Plan

## Portland Harbor Pre-Remedial Design Investigation and Baseline Sampling

## Portland Harbor Superfund Site

AECOM Project Number: 60554349
Geosyntec Project Number: PNG0767

October 30, 2019

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**CERTIFICATION**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Kenneth M. Tyrrell
PDI Project Coordinator
AECOM Technical Services

Date

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AECOM | AECOM Technical Services |
| ASAOC | Administrative Settlement and Agreement Order on Consent |
| CRD | Columbia River Datum |
| DEA | David Evans & Associates, Inc. |
| EPA | United States Environmental Protection Agency |
| FC | Field Coordinator |
| FS | feasibility study |
| FSP | Field Sampling Plan |
| Geosyntec | Geosyntec Consultants, Inc. |
| GNSS | Global Navigation Satellite System |
| HAZWOPER | Hazardous Waste Operations and Emergency Response |
| HIPS | Hydrographic Image Processing System |
| LWG | Lower Willamette Group |
| NAD83/91 | North American Datum of 1983/1991 |
| NAVD88 | North American Vertical Datum of 1988 |
| OSHA | Occupational Safety and Health Administration |
| PDI | Pre-Remedial Design Investigation |
| PHSS | Portland Harbor Superfund Site |
| Pre-RD AOC Group | Pre-Remedial Design ~~Investigation~~Agreement and Order on Consent Group |
| PWC | personal water craft |
| QAPP | Quality Assurance Project Plan |
| RI | remedial investigation |
| RM | river mile |
| ROD | Record of Decision |
| SIPS | Sonar Image Processing System |
| Site | Portland Harbor Superfund Site |
| SOW | Statement of Work |
| USACE | U.S. Army Corps of Engineers |

# 1. INTRODUCTION

The Record of Decision (ROD) described a post-ROD sampling effort for the Portland Harbor Superfund Site (Site or PHSS; Figure 1) located in Portland, Oregon, to delineate and better refine the sediment management area footprints, refine the Conceptual Site Model, determine baseline conditions, and support remedial design (United States Environmental Protection Agency [EPA] 2017a). Geosyntec Consultants, Inc. (Geosyntec), and AECOM Technical Services (AECOM) have submitted a Work Plan for Pre-Remedial Design Investigations (PDI) on behalf of a group of industrial parties called the Pre-Remedial Design ~~Investigation~~Agreement and Order on Consent Group (Pre-RD AOC Group). In winter 2017, EPA entered into an Administrative Settlement ~~and~~ Agreement and Order on Consent (ASAOC) with the Pre-RD AOC Group to conduct the PDI studies at the Site (EPA 2017b). The Statement of Work (SOW), which is an appendix to the ASAOC, and the Work Plan (as an attachment to the SOW) generally describe the field investigation activities, data analyses, schedule, and deliverables for the PDI.

A remedial investigation (RI)/feasibility study (FS) was initiated in 2001 by a group of potentially responsible parties known as the Lower Willamette Group (LWG) and completed by EPA in 2016 (EPA 2016a, 2016b). The RI consisted of three rounds of data collection, including surface and subsurface sediment, bank soils, surface water, sediment traps, porewater, and fish tissue from 2001 through 2007.

The Work Plan (Geosyntec 2017) is a focused and foundational step in what will be a multi-phase effort to update current conditions from the collection of data over the past 15 years. It provides an overview of studies that will be prepared for the PDI at the PHSS. This Field Sampling Plan (FSP) was prepared to support the bathymetric survey efforts outlined in the Work Plan and the project Quality Assurance Project Plan (AECOM and Geosyntec 2018). The Site-wide bathymetry survey is intended to refresh and update the surface bed elevations to current conditions and fill in no-coverage areas (especially nearshore) to support the initial remedial design activities.

## 1.1 Project Setting

The PHSS is located in Portland, Oregon, on the lower Willamette River immediately downstream of the urban downtown. The Willamette River is a dynamic waterbody that originates within Oregon in the Cascade Mountain Range and flows approximately 187 miles north to its confluence with the Columbia River. The Site extends from river mile (RM) 1.9 near the mouth of the Willamette River upstream to RM 11.8 (Figure 1). The Downtown Reach, which includes the urbanized area of downtown Portland, is defined by EPA as extending from RM 11.8 to RM 16.6. EPA defines the Upriver Reach as extending from RM 16.6 to RM 28.4.

The Site includes a water-dependent, highly industrialized area, which contains a multitude of facilities and both private and municipal outfalls. Land use along the lower Willamette River in the Portland Harbor includes marine terminals, manufacturing and other commercial and

municipal operations, and public facilities, parks, and open spaces (EPA 2016b). A federally maintained Navigation Channel, extending nearly bank-to-bank in some areas, doubles the natural depth of the river and allows transit of large ships into the active harbor; the PHSS serves as a major shipping route for containerized and bulk cargo. Common shoreline features within the harbor include constructed bulkheads, piers, wharves, buildings extending over the water, and steeply sloped banks armored with riprap or other fill materials (EPA 2016b). The State of Oregon owns certain submerged and submersible lands underlying navigable and tidally influenced waters.

## 1.2 Project Overview and Objectives

The scope of this FSP includes conducting a bank-to-bank[1] bathymetric survey of the lower Willamette River from RM 1.9 to 11.8 and down the Multnomah Channel to the Sauvie Island Bridge; see Figure 1 for the coverage area. Vertically, the coverage area will extend up the riverbanks to an elevation of +13.0 ~~7.8~~ feet ~~Columbia River Datum (CRD) or +12.8~~ North American Vertical Datum of 1988 [NAVD88] or approximately +7.8 feet Columbia River Datum (CRD) where practical (Figure 2). The vertical coverage elevation of +13.0 feet NAVD88 was selected as the target for the bathymetric survey extent based on the Final 2016 Portland Harbor RI/FS Figure 2.2-1 (Figure 3). ~~This elevation encompasses the bank cleanup areas depicted in the ROD and will support future remedial design efforts.~~

The bathymetric survey will document current bed elevations throughout the Site. This survey will include all accessible nearshore areas (e.g., Swan Island Lagoon), as well as the federal Navigation Channel. The data set will also assess changes in elevation/sedimentation as technically feasible using the pre-existing surveys; the most comprehensive survey of the Site was conducted in 2004 (and was used in the FS). Multi-beam sonar will be used to collect high-resolution data with maximum coverage of the riverbed where accessible. If additional coverage is needed in nearshore areas that are difficult to access, then custom personal water crafts (PWCs) or Remote-Controlled Q-boat equipped with single-beam sonar, ~~or~~ lead-line measurements, or airborne LiDAR data may be used. Equipment used in each area will depend on the water elevation at the time of surveying. David Evans and Associates, Inc. (DEA), the preferred contractor for conducting the bathymetric survey, will utilize the highest quality equipment it has that meets the minimum survey depth capable, 2.5 feet for PWCs or 1.5 feet for the Q-boat; additional equipment specifications are provided in DEA's 2018 *Hydrographic Survey Work and Quality Control Plan* (Appendix A). To maximize efficiency and extend multi-beam coverage, the survey should be conducted during high river levels that exceed 15.0 feet NAVD88. Surveying at lower river levels will increase survey time.

If needed for spatial coverage, DEA will develop a second Work Plan that will describe how LiDAR will be collected or adapted from other studies and include the technical specifications. The LiDAR Work Plan would be a post-approval addendum to this FSP if it is determined that

[1] For this FSP, the "bank" is defined as an elevation of ~~+7.8 feet above the CRD or +~~12~~.83~~ feet above the NAVD88 or approximately +7.8 feet above the CRD.

LiDAR is necessary to collect data up to the desired +13.0 feet NAVD88. This data gap assessment will be conducted after the multi-beam and single-beam field work has been completed. The data collection and processing methods will ~~closely~~ follow procedures outlined in DEA's ~~*by David Evans & Associates, Inc. (DEA), in its 2001 2018 Multi-beam Bathymetry Survey for the Lower Willamette River Work Plan*~~*Hydrographic Survey Work and Quality Control Plan* (Appendix A).

DEA has acquired five surveys of the Portland Harbor since 2002 on behalf of the LWG. DEA performed surveys for the LWG in January and July 2002, May 2003, February 2004, and February 2007 as part of the Portland Harbor RI/FS. Additionally, a June 2009 survey of the Willamette River was conducted by DEA for the National Ocean and Atmospheric Administration to update nautical charts.

The new bathymetric data, collected as part of this PDI study, will be used to:

- Update baseline maps;
- Support sediment sampling efforts;
- Refine the elevation clearances for dredging and capping;
- Help estimate shoaling and scouring areas relative to previous surveys; and
- Support confirmation of the estimated dredge volume.

Bathymetry results may serve as a line of evidence for evaluating riverbed slope conditions, recovery potential, and bed stability (e.g., erosional versus depositional areas).

## 1.3 Project Organization

Team organization is detailed in the PDI Work Plan and in Section 2 of the Quality Assurance Project Plan (QAPP) (AECOM and Geosyntec 2018a). As it relates to this FSP, AECOM and Geosyntec are coordinating activities including management of all subcontractors, field sampling, analysis, and reporting scoping tasks. The PDI Project Coordinator, Ken Tyrrell, and PDI Project Manager, Jennifer Pretare, (AECOM), will be responsible for overall project coordination and providing oversight on all project deliverables. Anne Fitzpatrick (Geosyntec) is the project's senior technical lead for this task. Nicky Moody (AECOM) and Keith Kroeger (Geosyntec) will be the Project Field Coordinators (FCs) and will be generally responsible for field quality assurance/quality control oversight.

Luke Smith (Geosyntec) will be the technical lead for this FSP and responsible for communication with DEA and provide oversight during field work. ~~Geosyntec will provide~~Luke Smith is a licensed Professional Engineer that maintains 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) training and 8-hour OSHA HAZWOPER Supervisor training. While providing oversight,

Geosyntec will ensure that DEA accurately collects critical data and will work with DEA to analyze post-survey data.

DEA will perform vessel support with Jon Dasler as the point of contact. Details of DEA boats and crew are provided in Appendix A. The hydrographic survey crew will consist of one boat with two hydrographers from DEA and one Professional Engineer from Geosyntec. The DEA survey crew has conducted numerous multi-beam and side-scan sonar surveys and has had extensive training in hydrographic surveys. DEA hydrographic staff members have attended training courses and have many years of experience in multi-beam and side-scan sonar operations. DEA's hydrographic staff has completed a 1-week training session in the use of CARIS Hydrographic Image Processing System (HIPS) and the Sonar Image Processing System (SIPS).

### 1.4 Communication/Information Flow

The communication strategy is outlined in Section 2 of the QAPP (AECOM and Geosyntec 2018a). In brief, the FCs will be the points of contact for field staff during the implementation of this FSP. Luke Smith will be the point person for the team on the boat with DEA. Deviations from this FSP or the project-specific QAPP will be reported to the project's senior technical lead and PDI Project Manager, for consultation. Significant deviations from the FSP/QAPP will be further reported to representatives of the Pre-RD AOC Group and EPA by the PDI Project Coordinator.

### 1.5 Coordination with EPA

The PDI Project Coordinator will notify the EPA Project Manager 1 week prior to beginning any field activities so that EPA can schedule any oversight activities required. The PDI Project Coordinator will also notify the EPA Project Manager once field activities have been completed.

## 2. SCOPE OF WORK

This FSP will follow the technical approaches presented ~~in the~~ by DEA in Appendix A, which follows the National Geospatial Data Policy (EPA 2008) and National Geospatial Data Policy Procedure for Geospatial Metadata Management (EPA 2010). ~~—~~DEA's 2018 *Hydrographic Survey Work and Quality Control Plan* (Appendix A) provides ~~for~~ horizontal/vertical control methods, instrumentation, and survey methodology associated with providing hydrographic services, mapping, and data management.

~~Per the previously EPA-approved survey approach outlined in DEA's Work Plan, t~~The primary vessel that will be used during the ~~he Site-wide~~ multi-beam bathymetry survey ~~will be acquired~~is the William R. Broughton; a 24-foot survey vessel outfitted with dual Teledyne Reson SeaBat T50-P precision multi-beam sonars. Prior to deploying survey vessels, the DEA crew will perform a static position check using the check antenna; this process verifies correctors are being

obtained and validates geodetic parameters. Validation of base station position and height relative to project datum will follow procedures discussed in Appendix A.

~~with a dual-head sonar along the shoreline with the shore-side sonar tilted toward the shoreline to maximize coverage in a single pass.~~ All bathymetric surveying will be consistent with prior surveys for the ~~LWG~~RI/FS and will conform ~~with~~to the standards established by the U.S. Army Corps of Engineers (USACE) ~~*Engineering and Design:*~~ *Hydrographic Surveying (Engineer Manual 1110-2-1003)* (USACE ~~2004~~2013), in accordance with requirements for "Navigation & Dredging Support Surveys." DEA has developed an updated Work Plan associated with this planned survey work (Appendix A) that discusses the technical specifications that will be used in the field. Targeted vertical and horizontal accuracy for the surveying is plus or minus 0.3 feet at a 95% confidence level. All work will be supervised and final deliverables approved by a DEA Oregon-registered Professional Land Surveyor and National Society of Professional Surveyors/The Hydrographic Society of America Certified Hydrographer. The bathymetric surveying will be based on the remedial design and performance monitoring data needs and will be consistent with previous site surveys.~~Following these previously approved procedures will ensure the data meets the required accuracy stated in the technical specifications.~~

As a modification to the multi-beam surveys performed by DEA on behalf of the LWG, fill lines will be run by DEA with a custom PWC equipped with a survey-grade, single-beam bathymetric sonar system to supplement data gaps. The multi-beam bathymetric data will be used to create a digital terrain model of the riverbed morphology from which hillshade images will be generated. During lower times in the daily tide cycle and when there is less daylight, deeper water will be surveyed (Navigation Channel). When there is better daylight and higher water elevations, shoreline areas will be surveyed. The river will be worked in sections covering bank-to-bank to minimize vessel travel time and maximize survey time.

To check the accuracy of the positioning system and confirm that the geodetic parameters used in the real-time projection to the North American Datum of 1983/1991 (NAD83/91) Oregon North Zone coordinate system are correct, a position check on ~~an~~ established monuments will be conducted~~ on a few of the remaining original monuments used in the RI/FS and will be incorporated into the study if practical~~. Figure 4 ~~and Figure 5~~ shows historical monuments that were referenced in ~~DEA's~~ DEA's 2004 field survey report for the Portland Harbor RI, and Table 1 lists the coordinates, which includes their permanently operating Global Navigation Satellite System (GNSS) reference station. The GNSS station will be used for survey control. Trimble SPS-855 dual frequency GNSS receiver will be the primary equipment used for recording and processing GNSS signals.

## 3. PROJECT SCHEDULE

The bathymetry survey is anticipated to take place in ~~mid~~late ~~-~~February/early~~-~~ March of 2018. The survey is expected to take 7 days, with 2 days of contingency. Possible scheduling conflicts that will be considered to optimize field time are barge fleeting, vessels at berth, oil booms,

structures, and restrictions around United States Navy vessels. Schedule adjustments may take place if water levels do not accommodate shallow nearshore/bank elevation goals.

# 4. DATA MANAGEMENT AND REPORTING

Data ~~validation~~verification and data management will be performed according to the ~~Draft~~Final Data Quality Management Plan ~~(DQMP)~~, current draft dated January 17, 2018 (AECOM 2018b). Data management while in the field will follow ~~similar~~ protocols as put forth in ~~the DEA 2001~~Appendix A, *Hydrographic Survey Work and Quality Control Plan* ~~from the RI (Appendix A)~~. Following data collection, DEA will provide data processing and associated mapping consistent with prior surveys conducted by DEA for the LWG. Sounding and topographic data will be recorded to a resolution of one tenth of a foot, vertical and horizontally. Processed data will be binned to a grid size of 3 feet by 3 feet to be used for contour generation, hillshade imagery, and differencing to available prior surveys.

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~~DEA will use data collected on behalf of the LWG in February 2004 to conduct difference analyses against the data collected under this FSP. Based on discussion with the Pre-RD Group, additional years can be analyzed for difference analyses.~~ Post-processing of multi-beam data will be conducted using ~~Caris~~ CARIS ~~Senior Workstation~~Onboard and CARIS ~~with~~ HIPS multi-beam analysis ~~and presentation~~ software. Patch test data will be analyzed, and any alignment corrections will be applied. The ~~Caris~~ CARIS HIPS system allows for simultaneous viewing of the side-scan and multi-beam data to analyze anomalies on the riverbed during post-processing. Additional multi-beam data processing conducted by DEA is presented in Appendix A.

Processing will begin with review of each survey line using ~~Caris~~ CARIS ~~swath~~ HIPS editor. Verified water surface correctors will be applied to the data set at this time. Position and sensor data will be reviewed and accepted. Sounding data will be reviewed and edited for data flyers such as returns from piling and passing vessel wakes. These data points are flagged and not used as part of the final data set. Sounding data, including sonar beams reflecting from sediment in the water column or noise due to aeration in the water column, are carefully reviewed before flagging as a data flyer. In each case, data will not be eliminated and can be unflagged during the subset editing process (Appendix A).

After swath editing, all data will be reviewed through the ~~Caris~~ CARIS HIPS subset editing program to ensure no flyers remain in the data set or to re-accept data previously flagged in the swath editor. A series of subsets are made to cover multiple lines in the ~~Caris~~ CARIS session. Using this method, sequential lines will be reviewed together to ensure agreement to one another (Appendix A).

# 5. DELIVERABLES

A series of map products will be provided at a scale of 1 inch to 400 feet and will include a hard copy set and digital data (in AutoCAD or ESRI compatible files) of the following:

- Contour maps of the surveyed area at a 2-foot contour interval
- Hill-shaded relief maps color-coded by depth of the surveyed area
- ~~Georeferenced TIFF images for each difference analysis~~ASCII x, y, z point data files for final merged data ~~model and difference data~~
- Metadata that conforms to the National Geospatial Data Policy
- ~~Polygon of the spatial extent of each survey used in the difference analysis~~
- Report in PDF format outlining survey equipment, methods, and analysis and describing any deviations from the Work Plan

~~Deliverables will also include a report outlining survey equipment, method, and analysis.~~

# 6. REFERENCES


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USACE (U.S. Army Corps of Engineers). 2013. Hydrographic Surveying (Engineer Manual 1110-2-1003). November ~~USACE (U.S. Army Corps of Engineers). 2004. Engineering and Design: Hydrographic Surveying (Engineer Manual 1110-2-1003). April.~~

# TABLES

## FIGURES ~~and TABLES~~

## APPENDIX A

David Evans & Associates, ~~Multi-beam Bathymetric Survey of the Lower Willamette River Work Plan~~2018 Hydrographic Survey Work and Quality Control Plan Portland Harbor PDI Studies

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